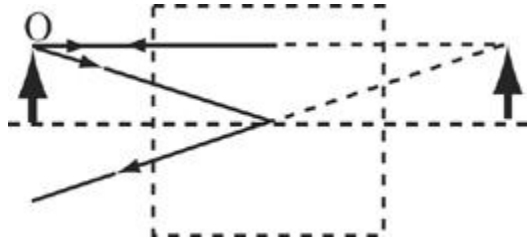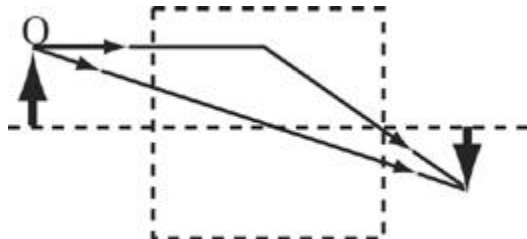SAT Physics Practice Paper 14

1. In the diagram accompanying each question, representative light rays from an illuminated object (labeled "O" in the diagrams) interact with an optical device (or devices): a mirror, a lens, or a combination of both. In each case, identify the optical device(s)—from among the choices below—that is/are most likely in the dotted box.

A. Plane mirror

B. Converging lens

C. Diverging lens

D. Plane mirror and a converging lens

E. Plane mirror and a diverging lens

2. In the diagram accompanying each question, representative light rays from an illuminated object (labeled "O" in the diagrams) interact with an optical device (or devices): a mirror, a lens, or a combination of both. In each case, identify the optical device(s)—from among the choices below—that is/are most likely in the dotted box.
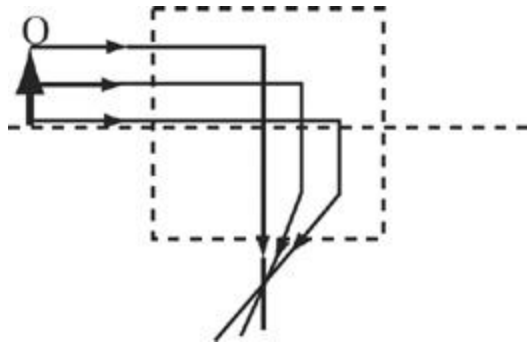

A. Plane mirror

B. Converging lens

C. Diverging lens

D. Plane mirror and a converging lens

E. Plane mirror and a diverging lens

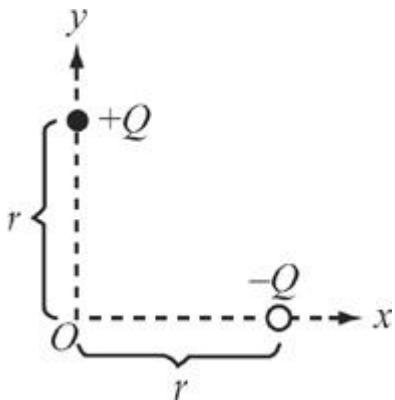**3.** In the diagram accompanying each question, representative light rays from an illuminated object (labeled "O" in the diagrams) interact with an optical device (or devices): a mirror, a lens, or a combination of both. In each case, identify the optical device(s)—from among the choices below—that is/are most likely in the dotted box.

A. Plane mirror

B. Converging lens

C. Diverging lens

D. Plane mirror and a converging lens

E. Plane mirror and a diverging lens

4. A superconductor is

A. a device used to study the collisions of subatomic particles that have been accelerated to near light speeds

B. a hollow, doughnut-shaped device containing a strong magnetic field for confinement of very high temperature plasmas

C. an element used to generate high-energy coherent laser light

D. an element whose supercooled vapor fills a cloud chamber to detect the tracks of charged particles when they initiate condensation of the vapor

E. an element or alloy whose electrical resistivity vanishes when cooled to extremely low temperatures

5.

Two equal but opposite point charges are fixed in position on the *x* and *y* axes, as shown in the figure above. Which of the following arrows best illustrates the direction of the resulting electric field at the origin, *O*?

A. ↗

B. ↖

C. ↗

D. ↘

E. ←

6. The planet Jupiter is 5 times farther from the sun than the earth, and the mass of Jupiter is 300 times the mass of the earth. If F_J is the strength of the gravitational force exerted by the sun on Jupiter, and F_E is the strength of the gravitational force exerted by the sun on the earth, what's the value of the ratio $\dfrac{F_J}{F_E}$?

A. $\dfrac{1}{60}$

B. $\dfrac{1}{12}$

C. 8

D. 12

E. 60

7. Consider a double-slit interference experiment using yellow light of wavelength λ, with the slits labeled S_1 and S_2. If P is the center of a dark fringe on the screen on which the resulting diffraction pattern is projected, which of the following equations relating S_1P and S_2P, the distances from slits S_1 and S_2, respectively, to the point P could be true?

A. $S_1P - S_2P = \dfrac{1}{2}\lambda$

B. $S_1P - S_2P = \lambda$

C. $S_1P - S_2P = 2\lambda$

D. $S_1P - S_2P = 3\lambda$

E. $S_1P = S_2P$

8. A pair of tuning forks produce sound waves that travel through the air. The frequency of the sound waves produced by the first tuning fork is 440 Hz, and the frequency of the sound waves produced by the second tuning fork is 880 Hz. If v_1 denotes the speed of the sound waves produced by the first tuning fork and v_2 denotes the speed of the sound waves produced by the second turning fork, then

A. $v_1 = 2v_2$

B. $v_1 = 4v_2$

C. $v_1 = v_2$

D. $v_2 = 2v_1$

E. $v_2 = 4v_1$

9. A block of aluminum and a block of iron each absorb the same amount of heat, and both blocks remain solid. The mass of the aluminum block is twice the mass of the iron block. If the specific heat of aluminum is twice the specific heat of iron, then

A. the increase in temperature of the aluminum block is twice the increase in temperature of the iron block

B. the increase in temperature of the aluminum block is four times the increase in temperature of the iron block

C. the increase in temperature of the aluminum block is the same as increase in temperature of the iron block

D. the increase in temperature of the iron block is twice the increase in temperature of the aluminum block

E. the increase in temperature of the iron block is four times the increase in temperature of the aluminum block

10. If a container contains a mixture of two ideal gases (of different molecular masses) at thermal equilibrium, which of the following is true?

A. The average kinetic energy of the molecules of the lighter gas is less than the average kinetic energy of the molecules of the heavier gas.

B. The average kinetic energy of the molecules of the lighter gas is greater than the average kinetic energy of the molecules of the heavier gas.

C. The average speed of the molecules of the lighter gas is less than the average speed of the molecules of the heavier gas.

D. The average speed of the molecules of the lighter gas is equal to the average speed of the molecules of the heavier gas.

E. The average speed of the molecules of the lighter gas is greater than the average speed of the molecules of the heavier gas.

11. A vertically polarized plane wave (an AM radio wave) is emitted by a radio antenna and travels across flat ground. Which of the following could describe the direction of the magnetic field component of the wave?

A. Parallel to the ground and perpendicular to the direction of propagation

B. Perpendicular to the ground and to the direction of propagation

C. Parallel to the ground and to the direction of propagation

D. Perpendicular to the ground and parallel to the direction of propagation

E. Parallel to the electric field component of the wave

12. Which of the following best describes the relationship between the frequency and amplitude of a sound wave?
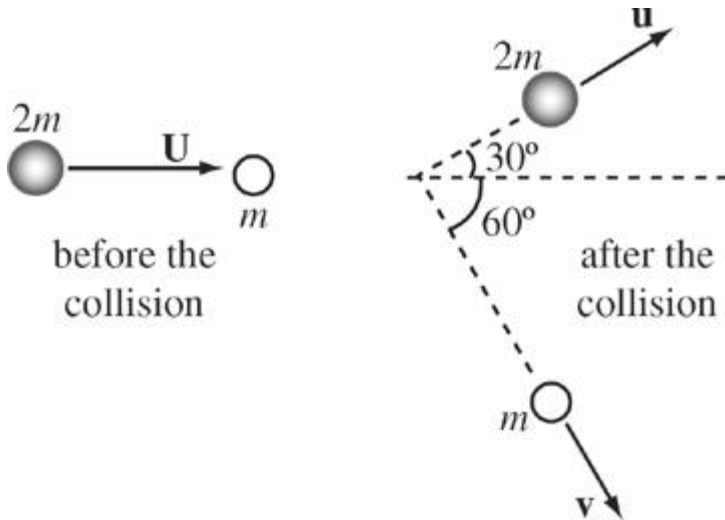
A. Frequency is proportional to amplitude.

B. Frequency is proportional to the square of the amplitude.

C. Frequency is inversely proportional to amplitude.

D. Frequency is inversely proportional to the square of the amplitude.

E. Frequency and amplitude are independent.

13. An atom whose nucleus contains 17 protons and 20 neutrons is a chlorine atom. Which of the following describes the composition of the nucleus of an isotope of chlorine?

A. 20 protons, 17 neutrons

B. 19 protons, 18 neutrons

C. 18 protons, 18 neutrons

D. 17 protons, 19 neutrons

E. 16 protons, 20 neutrons

14. When a projectile moving in a parabolic path reaches its highest point above the ground,

A. its velocity is instantaneously zero

B. its acceleration is instantaneously zero

C. its weight balances the force of air resistance

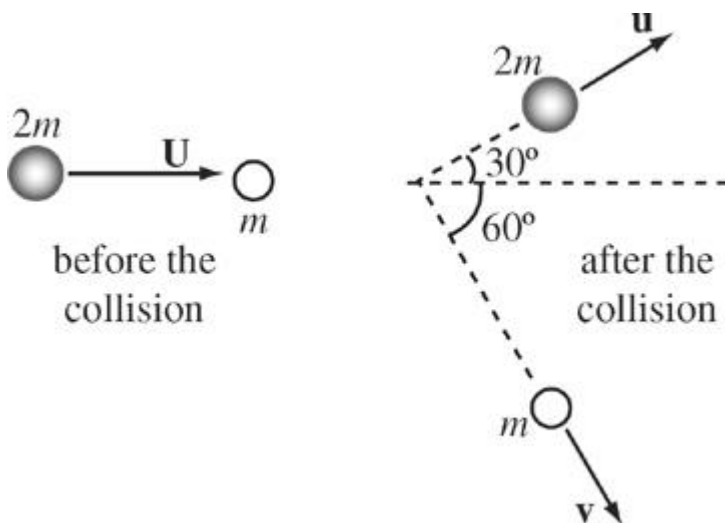D. the net force it feels is instantaneously zero

E. None of the above

15.

An object of mass 2*m* moving with velocity **U** strikes an object of mass *m* initially at rest. After the collision, the objects move away with velocities **u** and **v**, as shown.

Which one of the following equations correctly relates *u* and *v*?

A. 2*u* cos 30° = *v* cos 60°

B. *u* cos 30° = 2*v* cos 60°

C. 2*u* sin 30° = *v* sin 60°

D. *u* sin 30° = 2*v* sin 60°

E. *u* sin 30° = *v* cos 60°

16.

An object of mass 2*m* moving with velocity **U** strikes an object of mass *m* initially at rest. After the collision, the objects move away with velocities **u** and **v**, as shown.

If the collision is elastic, then

A. $U^2 = u^2 - \dfrac{1}{2}v^2$

B. $U^2 = u^2 + \dfrac{1}{2}v^2$

C. $U = u - \dfrac{1}{2}v$

D. $U = u + \dfrac{1}{2}v$

E. $(U - u)^2 = \dfrac{1}{2}v^2$

17. The acceleration due to gravity on the moon is 1/6 of its value on Earth. If an object weighs 20 N on the moon, what is its mass on Earth?

A. 2 kg

B. 7.2 kg

C. 12 kg

D. 60 kg

E. 72 kg

18. The electric field strength at a point some distance away from a source charge does NOT depend on

A. the magnitude of the source charge.

B. the sign of the source charge.

C. the distance from the source charge.

D. the nature of the medium surrounding the source charge.

E. None of the above

19. Which of the following equations best states the relationship between a material's coefficient of volume expansion due to heating, β, and its coefficient of linear expansion, α?
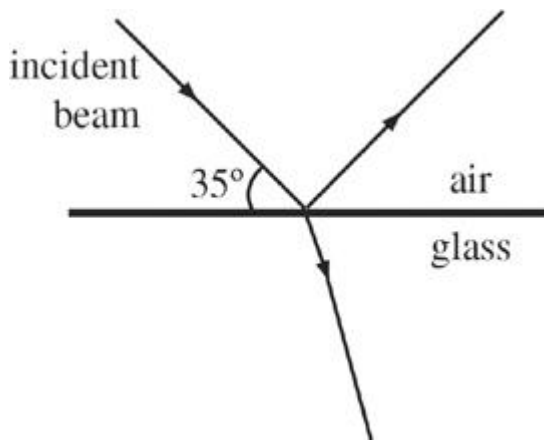
A. $\beta = \alpha$

B. $\beta = 3\alpha$

C. $\beta = \alpha + \alpha^2$

D. $\beta = \alpha^3$

E. $\beta = 3\alpha^3$

20. The ends of a long, taut tightrope are attached to two platforms. A tightrope artist walks along the tightrope and, upon reaching the middle, stops. Someone standing on one of the platforms grabs the rope near one end and sends a transverse wave pulse down the rope. When the pulse reaches the tightrope walker, he briefly rises upward, and the wave passes. This illustrates the fact that the wave transports
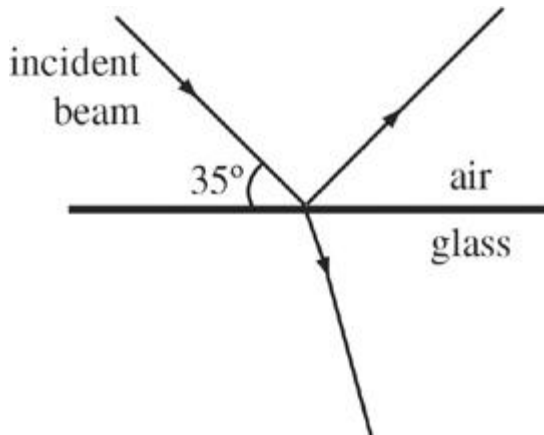
A. momentum

B. mass

C. weight

D. wavelength

E. density

21.

Note: The figure is not drawn to scale.

The figure above shows a beam of light striking the surface of a piece of glass from the air.

If the reflected beam and refracted beam are perpendicular to each other, what is the index of refraction of the glass?

A. sin 55°

B. 1/sin 55°

C. 1/sin 35°

D. sin 55°/sin 35°

E. sin 35°/sin 55°

22.

Note: The figure is not drawn to scale.

The figure above shows a beam of light striking the surface of a piece of glass from the air.

Let *n* denote the index of refraction of the glass. If the incident light has a frequency of *f* when traveling through the air, what is the wavelength of the light when it travels through the glass?

A. *fc/n*

B. *n/fc*

C. *c/f*

D. *nc/f*

E. *c/nf*

23. An electron that accelerates from a point near a collection of negative source charges toward a point near a collection of positive source charges experiences

A. a decrease in electrical potential energy as it moves toward a region at a lower electric potential

B. a decrease in electrical potential energy as it moves toward a region at a higher electric potential

C. an increase in electrical potential energy as it moves toward a region at a lower electric potential

D. an increase in electrical potential energy as it moves toward a region at a higher electric potential

E. no change in electrical potential energy

24. As the air around the base of a candle flame is heated, it rises and is replaced by cooler air. This illustrates what type of heat transfer?

A. Conduction

B. Convection

C. Radiation

D. Diffraction

E. Latent heat

25. Five identical spaceships take off from Planet X, and each passes by Planet Y at a constant speed on its way to Planet Z. A science station on Planet Y observes them passing by. The spaceship traveling at which of the following speeds would be observed to have the greatest length?

A. 6×10^7 m/s

B. 9×10^7 m/s

C. 1×10^8 m/s

D. 1.5×10^8 m/s

E. 2×10^8 m/s